In the Claims:

Kindly amend the claims as follows:

1. (Currently Amended) A treatment of waste process comprises oxidizing mixed waste by (a) dissolution of transuranic elements plutonium, neptunium, americium, curium, and californium, and/or compounds thereof in transuranic waste (TRUW), low level waste (LLW), low level mixed waste (LLMW), special case waste (SCW), and greater than class C (GTCC) LLW; (b) destruction of non-fluorocarbon organic component in the waste; or (c) decontamination of transuranic/actinide contaminated equipment, further comprising disposing an electrolyte in an electrochemical cell, separating the electrolyte into an anolyte portion and a catholyte portion with an ion-selective membrane, microporous plastic, porous ceramic or glass frit or semi permeable membrane, applying a direct current voltage between the anolyte portion and the catholyte portion, placing the mixed waste and/or transuranic/actinides materials in the anolyte portion, and oxidizing the mixed waste and/or transuranic/actinides materials in the anolyte portion with a mediated electrochemical oxidation (MEO) process, wherein the anolyte portion further comprises a mediator oxidizing species in aqueous solution and containing an acid, neutral or alkaline electrolytes, and wherein the mediator oxidizing species are simple anion redox couples described in Table I as below; Type I isopolyanions complex anion redox couples formed by incorporation of Mo, W, V, Nb, Ta, or mixtures thereof as addenda atoms; Type I heteropolyanions complex anion redox couples formed by incorporation in to Type I isopolyanions as heteroatoms any of the elements listed in Table II either singly or in combination thereof, or heteropolyanions complex anion redox couples containing at least one heteroatom type element contained in both Table I and Table II below or combinations of the mediator oxidizing species from any or all of these generic groups:

Table I: Simple Anion Redox Couples

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
I	A	None			
	B	Copper (Cu)	+2	Cu^{-2} (cupric) $HCuO_2$ (bicuprite) CuO_2^{-2} (cuprite)	+2 Species/ +3, +4 Species; +3 Species/ +4 Species
			+3	Cu^{+3} CuO_2^- (cuprate) Cu_2O_3 (sesquioxide)	
			+4	CuO_2 (peroxide)	
		Silver (Ag)	+1	Ag^+ (argentous) AgO^- (argentite)	+1 Species/ +2, +3 Species; +2 Species/ +3 Species
			+2	Ag^{-2} (argentic) AgO (argentic oxide)	
			+3	AgO^+ (argentyl) Ag_2O_3 (sesquioxide)	
		Gold (Au)	+1	Au^+ (aurous)	+1 Species/ +3, +4 Species; + 3 Species/ +4 Species
			+3	Au^{+3} (auric) AuO^- (auryl) $H_3AuO_3^-$ (auric acid) $H_2AuO_3^-$ (monoauarate) $HAuO_3^{-2}$ (diaurate) AuO_3^{-3} (triaurate) Au_2O_3 (auric oxide) $Au(OH)_3$ (auric hydroxide)	
			+4	AuO_2 (peroxide)	
II	A	Magnesium (Mg)	+2	Mg^{+2} (magnesic)	+2 Species/ +4 Species
			+4	MgO_2 (peroxide)	
		Calcium (Ca)	+2	Ca^{+2}	+2 Species/ +4 Species
			+4	CaO_2 (peroxide)	
		Strontium	+2	Sr^{+2}	+2 Species/ +4 Species
			+4	SrO_2 (peroxide)	
		Barium (Ba)	+2 +4	Ba^{+2} BaO_2 (peroxide)	+2 Species/ +4 Species

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
II	B	Zinc (Zn)	+2	Zn^{+2} (zincic) $ZnOH^{+}$ (zincyl) $HZnO_2^{-}$(bizincate) ZnO_2^{-2} (zincate)	+2 Species/ +4 Species
			+4	ZnO_2 (peroxide)	
		Mercury (Hg)	+2	Hg^{+2} (mercuric) $Hg(OH)_2$ (mercuric hydroxide) $HHgO_2^{-}$ (mercurate)	+2 Species/ +4 Species
			+4	HgO_2 (peroxide)	
III	A	Boron	+3	H_3BO_3 (orthoboric acid) $H_2BO_3^{-}$, HBO_3^{-2}, BO_3^{-3} (orthoborates) BO_2^{-} (metaborate) $H_2B_4O_7$ (tetraboric acid) $HB_4O_7^{-}/B_4O_7^{-2}$ (tetraborates) $B_2O_4^{-2}$ (diborate) $B_6O_{10}^{-2}$ (hexaborate)	+3 Species/ +4.5, +5 Species
			+4.5	$B_2O_5^{-}$ (diborate)	
			+5	$BO_3^{-}/BO_2^{-}\cdot H_2O$ (perborate)	
		Thallium (Tl)	+1	Tl^{+1} (thallous)	+1 Species/ +3 or +3.33 Species; +3 Species/ +3.33 Species
			+3	Tl^{+3} (thallic) TlO^{+}, $TlOH^{+2}$, $Tl(OH)_2^{\pm}$ (thallyl) Tl_2O_3 (sesquioxide) $Tl(OH)_3$ (hydroxide)	
			+3.33	Tl_3O_5 (peroxide)	
	B	See Rare Earths and Actinides			

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
IV	A	Carbon (C)	+4	H_2CO_3 (carbonic acid)	+4 Species/ +5, +6 Species
				HCO_3^- (bicarbonate)	
				CO_3^{-2} (carbonate)	
			+5	$H_2C_2O_6$ (perdicarbonic acid)	
			+6	H_2CO_4 (permonocarbonic acid)	
		Germanium (Ge)	+4	H_2GeO_3 (germanic acid)	+4 Species/ +6 Species
				$HGeO_3^-$ (bigermaniate)	
				GeO_3^{-4} (germinate)	
				Ge^{+4} (germanic)	
				GeO_4^{-4}	
				$H_2Ge_2O_5$ (digermanic acid)	
				$H_2Ge_4O_9$ (tetragermanic acid)	
				$H_2Ge_5O_{11}$ (pentagermanic acid)	
				$HGe_5O_{11}^-$ (bipentagermanate)	
			+6	$Ge_5O_{11}^{-2}$ (pentagermanate)	
		Tin (Sn)	+4	Sn^{+4} (stannic)	+4 Species/ +7 Species
				$HSnO_3^-$ (bistannate)	
				SnO_3^{-2} (stannate)	
				SnO_2 (stannic oxide)	
				$Sn(OH)_4$ (stannic hydroxide)	
			+7	SnO_4^- (perstannate)	
		Lead (Pb)	+2	Pb^{+2} (plumbous)	+2, +2.67, +3 Species/+4 Species
				$HPbO_2^-$ (biplumbite)	
				$PbOH^+$	
				PbO_2^{-2} (plumbite)	
				PbO (plumbus oxide)	
			+2.67	Pb_3O_4 (plumbo-plumbic oxide)	
			+3	Pb_2O_3 (sequioxide)	
IV	A	Lead (Pb)	+4	Pb^{+4} (plumbic)	+2, +2.67, +3 Species/+4 Species
				PbO_3^{-2} (metaplumbate)	
				$HPbO_3^-$ (acid metaplumbate)	
				PbO_4^{-4} (orthoplumbate)	
				PbO_2 (dioxide)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
IV	B	Titanium	+4	TiO^{+2} (pertitanyl) $HTiO_4^-$ titanate) TiO_2 (dioxide)	+4 Species/ +6 Species
			+6	TiO_2^{+2} (pertitanyl) $HTiO_4^-$ (acid pertitanate) TiO_4^{-2} (pertitanate) TiO_3 (peroxide)	
		Zirconium (Zr)	+4	Zr^{+4} (zirconic) ZrO^{+2} (zirconyl) $HZrO_3^-$ (zirconate)	+4 Species/ +5, +6, +7 Species
			+5	Zr_2O_5 (pentoxide)	
			+6	ZrO_3 (peroxide)	
			+7	Zr_2O_7 (heptoxide)	
		Hafnium (Hf)	+4	Hf^{+4} (hafnic) HfO^{+2} (hafnyl)	+4 Species/ +6 Species
			+6	HfO_3 (peroxide)	
V	A	Nitrogen	+5	HNO_3 (nitric acid) NO_3^- (nitrate)	+5 species/ +7 Species
			+7	HNO_4 (pernitric acid)	
		Phosphorus (P)	+5	H_3PO_4 (orthophosphoric acid) $H_2PO_4^-$ (monoorthophosphate) HPO_4^{-2} (diorthophosphate) PO_4^{-3} (triorthophosphate) HPO_3 (metaphosphoric acid) $H_4P_2O_7$ (pryophosphoric acid) $H_5P_3O_{10}$ (triphosphoric acid) $H_6P_4O_{13}$ (tetraphosphoric acid)	+5 Species/ +6, +7 species
V	A	Phosphorus (P)	+6	$H_4P_2O_8$ (perphosphoric acid)	+5 Species/ +6, +7 Species
			+7	H_3PO_5 (monoperphosphoric acid)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
V	A	Arsenic (As)	+5	H_3AsO_4 (ortho-arsenic acid) $H_2AsO_4^-$ (mono ortho-arsenate) $HAsO_4^{-2}$ (di-ortho-arsenate) AsO_4^{-3} (tri-ortho-arsenate) AsO_2^+ (arsenyl)	+5 Species/ +7 species
			+7	AsO_3^+ (perarsenyl)	
		Bismuth (Bi)	+3	Bi^{+3} (bismuthous) $BiOH^{+2}$ (hydroxybismuthous) BiO^+ (bismuthyl) BiO_2^- (metabismuthite)	+3 Species/ +3.5, +4, +5 Species
			+3.5	Bi_4O_7 (oxide)	
			+4	Bi_2O_4 (tetroxide)	
			+5	BiO_3^- (metabismuthite) Bi_2O_5 (pentoxide)	
	B	Vanadium (V)	+5	VO_2^+ (vanadic) $H_3V_2O_7^-$ (pyrovanadate) $H_2VO_4^-$ (orthovanadate) VO_3^- (metavanadate) HVO_4^{-2} (orthovanadate) VO_4^{-3} (orthovanadate) V_2O_5 (pentoxide) $H_4V_2O_7$ (pyrovanadic acid) HVO_3 (metavanadic acid) $H_4V_6O_{17}$ (hexavanadic acid)	+5 Species/ +7, +9 Species
			+7	VO_4^- (pervanadate)	
			+9	VO_5^- (hypervanadate)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
V	B	Niobium (Nb)	+5	NbO_3^- (metaniobate) NbO_4^{-3} (orthoniobate) Nb_2O_5 (pentoxide) $HNbO_3$ (niobid acid)	+5 Species/ +7 species
			+7	NbO_4^- (perniobate) Nb_2O_7 (perniobic oxide) $HNbO_4$ (perniobic acid)	
		Tantalum (Ta)	+5	TaO_3^- (metatantalate) TaO_4^{-3} (orthotanatalate) Ta_2O_5 (pentoxide) $HTaO_3$ (tantalic acid)	+5 species/ +7 species
			+7	TaO_4^- (pentantalate) Ta_2O_7 (pertantalate) $HTaO_4 \cdot H_2O$ (pertantalic acid)	
VI	A	Sulfur (S)	+6	H_2SO_4 (sulfuric acid) HSO_4^- (bisulfate) SO_4^{-2} (sulfate)	+6 Species/ +7, +8 Species
			+7	$S_2O_8^{-2}$ (dipersulfate)	
			+8	H_2SO_5 (momopersulfuric acid)	
		Selenium (Se)	+6	$H_2Se_2O_4$ (selenic acid) $HSeO_4^-$ (biselenate) SeO_4^{-2} (selenate)	+6 species/ +7 Species
			+7	$H_2Se_2O_8$ (perdiselenic acid)	
		Tellurium (Te)	+6	H_2TeO_4 (telluric acid) $HTeO_4^-$ (bitellurate) TeO_4^{-2} (tellurate)	+6 species/ +7 species
			+7	$H_2Te_2O_8$ (perditellenic acid)	
		Polonium (Po)	+2	Po^{+2} (polonous)	+2, +4 species/ +6 Species
			+4	PoO_3^{-2} (polonate)	
			+6	PoO_3 (peroxide)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
VI	B	Chromium	+3	Cr^{+3} (chromic) $CrOH^{+2}$, $Cr(OH)_2^{+}$ (chromyls) CrO_2^{-}, CrO_3^{-3} (chromites) Cr_2O_3 (chromic oxide) $Cr(OH)_3$ (chromic hydroxide)	+3 Species/ +4, +6 Species; +4 Species/ +6 Species
			+4	CrO_2 (dioxide) $Cr(OH)_4$ (hydroxide)	
			+6	H_2CrO_4 (chromic acid) $HCrO_4^{-}$ (acid chromate) CrO_4^{-2} (chromate) $Cr_2O_7^{-2}$ (dichromate)	
		Molybdenum (Mo)	+6	$HMoO_4^{-}$ (bimolybhate) MoO_4^{-2} (molydbate) MoO_3 (molybdic trioxide) H_2MoO_4 (molybolic acid)	+6 Species/ +7 Species
			+7	MoO_4^{-} (permolybdate)	
		Tungsten (W)	+6	WO_4^{-2} tungstic) WO_3 (trioxide) H_2WO_4 (tungstic acid)	+6 Species/ +8 Species
			+8	WO_5^{-2} (pertungstic) H_2WO_5 (pertungstic acid)	
VII	A	Chlorine (Cl)	+1	HClO (hypochlorous acid) ClO^{-} (hypochlorite)	+1 Species/ +3, +5, +7 Species; +3 Species/ +5, +7 Species; +5 Species/ +7 Species
			+3	$HClO_2$ (chlorous acid) ClO_2^{-} (chlorite)	
			+5	$HClO_3$ (chloric acid) ClO_3^{-} (chlorate)	
			+7	$HClO_4$ (perchloric acid) ClO_4^{-}, $HClO_5^{-2}$, ClO_5^{-3}, $Cl_2O_9^{-4}$ (perchlorates)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
VII	A	Bromine (Br)	+1	HBrO (hypobromous acid) BrO^- (hypobromitee)	+1 Species/+3, +5, +7 Species; +3 Species/ +5, +7 Species; +5 Species/ +7 Species
			+3	$HBrO_2$ (bromous acid) $BrO2^-$ (bromite)	
			+5	$HBrO_3$ (bromic acid) BrO_3^- (bromate)	
			+7	$HBrO_4$ (perbromic acid) BrO_4^-, $HBrO_5^{-2}$, BrO_5^{-3}, $Br_2O_9^{-4}$ (prebromates)	
		Iodine	+1	HIO (hypoiodus acid) IO^- (hypoiodite)	+1 Species/+3, +5, +7 Species; +3 Species/ +5, +7 Species; +5 Species/ +7 Species
			+3	HIO_2 (iodous acid) IO_2^- (iodite)	
			+5	HIO_3 (iodic acid) IO_3^- (iodate)	
			+7	HIO_4 (periodic acid) IO_4^-, HIO_5^{-2}, IO_5^{-3}, $I_2O_9^{-4}$ (periodates)	
	B	Manganese (Mn)	+2	Mn^{+2} (manganeous) $HMnO_2^-$ (dimanganite)	+2 Species/ +3, +4, +6, +7 Species; +3 Species/ +4, +6, +7 Species; +4 Species/ +6, +7 Species; +6 Species/ +7 Species
			+3	Mn^{+3} (manganic)	
			+4	MnO_2 (dioxide)	
			+6	MnO_4^{-2} (manganate)	
			+7	MnO_4^- (permanganate)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
VIII	Period 4	Iron (Fe)	+3	Fe^{+3} (ferric) $Fe(OH)^{+2}$ $Fe(OH)_2^{\pm}$ FeO_2^{-2}(ferrite)	+3 Species/+4, +5, +6 Species;
			+4	FeO^{+2} (ferryl) FeO_2^{-2} (perferrite)	+4 Species/ +5, +6 Species; +5 Species/ +6 Species
			+5	FeO_2^{+} (perferryl)	
			+6	FeO_4^{-2} (ferrate)	
		Cobalt (Co)	+2	Co^{+2} (cobalous) $HCoO_2^{-}$ (dicobaltite)	+2 Species/ +3, +4 Species; +3 Species/ +4 Species
			+3	Co^{+3} (cobaltic) Co_2O_3 (cobaltic oxide)	
			+4	CoO_2 (peroxide) H_2CoO_3 (cobaltic acid)	
		Nickel (Ni)	+2	Ni^{+2} (nickelous) $NiOH^{+}$ $HNiO_2^{-}$ (dinickelite) NiO_2^{-2} (nickelite)	+2 Species/ +3, +4, +6 Species; +3 Species/ +4, +6 Species; +4 Species/ +6 Species
			+3	Ni^{+3} (nickelic) Ni_2O_3 (nickelic oxide)	
			+4	NiO_2 (peroxide)	
			+6	NiO_4^{-2} (nickelate)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
VIII	Period 5	Ruthenium (Ru)	+2	Ru^{+2}	+2 Species/ +3, +4, +5, +6, +7, +8 Species; +3 Species/ +4, +5, +6, +7, +8 Species; +4 Species/ +5, +6, +7, +8 Species; +5 Species/ +6, +7, +8 Species; +6 Species/ +7, +8 Species; +7 Species/ +8 Species
			+3	Ru^{+3} Ru_2O_3 (sesquioxide) $Ru(OH)_3$ (hydroxide)	
			+4	Ru^{+4} (ruthenic) RuO_2 (ruthenic dioxide) $Ru(OH)_4$ (ruthenic hydroxide)	
			+5	Ru_2O_5 (pentoxide)	
			+6	RuO_4^{-2} (ruthenate) RuO_2^{+2} (ruthenyl) RuO_3 (trioxide)	
			+7	RuO_4^- (perruthenate)	
			+8	H_2RuO_4 (hyperuthenic acid) $HRuO_5^-$ (diperruthenate) RuO_4 (ruthenium tetroxide)	
		Rhodium (Rh)	+1	Rh^+ (hyporhodous)	+1 Species/+2, +3, +4, +6 Species; +2 Species/ +3, +4, +6 Species; +3 Species/ +4, +6 Species; +4 Species/ +6 Species
			+2	Rh^{+2} (rhodous)	
			+3	Rh^{+3} (rhodic) Rh_2O_3 (sesquioxide)	
			+4	RhO_2 (rhodic oxide) $Rh(OH)_4$ (hydroxide)	
			+6	RhO_4^{-2} (rhodate) RhO_3 (trioxide)	
		Palladium	+2	Pd^{+2} (palladous) PdO_2^{-2} (palladite)	+2 Species/ +3, +4, +6 Species; +3 Species/ +4, +6 Species; +4 Species/ +6 Species
			+3	Pd_2O_3 (sesquioxide)	
			+4	$Pd\ O_3^{-2}$ (palladate) PdO_2 (dioxide) $Pd(OH)_4$ (hydroxide)	
			+6	PdO_3 (peroxide)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
VIII	Period 6	Iridium (Ir)	+3	Ir^{+3} (iridic) Ir_2O_3 (iridium sesquioxide) $Ir(OH)_3$ (iridium hydroxide)	+3 Species/ +4, +6 Species; +4 Species/ +6 Species
			+4	IrO_2 (iridic oxide) $Ir(OH)_4$ (iridic hydroxide)	
			+6	IrO_4^{-2} (iridate) IrO_3 (iridium peroxide)	
		Platinum (Pt)	+2	Pt^{+2} (platinous)	+2, +3 Species/ +4, +6 Species; +4 Species/ +6 Species
			+3	Pt_2O_3 (sesquioxide)	
			+4	PtO_3^{-2} (palatinate) PtO^{+2} (platinyl) $Pt(OH)^{+3}$ PtO_2 (platonic oxide)	
			+6	PtO_4^{-2} (Perplatinate) PtO_3 (perplatinic oxide)	
IIIB	Rare earths	Cerium (Ce)	+3	Ce^{+3} (cerous) Ce_2O_3 (cerous oxide) $Ce(OH)_3$ (cerous hydroxide)	+3 Species/ +4, +6 Species; +4 Species/ +6 Species
			+4	Ce^{+4}, $Ce(OH)^{+3}$, $Ce(OH)_2^{+2}$, $Ce(OH)_3^{+}$ (ceric) CeO_2 (ceric oxide)	
			+6	CeO_3 (peroxide)	
		Praseodymium (Pr)	+3	Pr^{+3} (praseodymous) Pr_2O_3 (sesquioxide) $Pr(OH)_3$ (hydroxide)	+3 species/ +4 species
			+4	Pr^{+4} (praseodymic) PrO_2 (dioxide)	
		Neodymium	+3	Nd^{+3} Nd_2O_3 (sesquioxide)	+3 Species/ +4 Species
			+4	NdO_2 (peroxide)	
		Terbium (Tb)	+3	Tb^{+3} Tb_2O_3 (sesquioxide)	+3 Species/ +4 Species
			+4	TbO_2 (peroxide)	

GROUP	SUB GROUP	ELEMENT	VALENCE	SPECIES	SPECIFIC REDOX COUPLES
IIIB	Actinides	Thorium (Th)	+4	Th^{+4} (thoric) ThO^{+2} (thoryl) $HThO_3^-$ (thorate)	+4 Species/ +6 Species
			+6	ThO_3 (acid peroxide)	
		Uranium (U)	+6	UO_2^{+2} (uranyl) UO_3 (uranic oxide)	+6 Species/ +8 Species
			+8	HUO_5^-, UO_5^{-2} (peruranates) UO_4 (peroxide)	
		Neptunium (Np)	+5	NpO_2^+ (hyponeptunyl) Np_2O_5 (pentoxide)	+5 Species/ +6, +8 Species; +6 Species/ +8 Species
			+6	NpO_2^{+2} (neptunyl) NpO_3 (trioxide)	
			+8	NpO_4 (peroxide)	
		Plutonium (Pu)	+3	Pu^{+3} (hypoplutonous)	+3 Species/ +4, +5, +6 Species; +4 Species/ +5, +6 Species; +5 Species/ +6 Species
			+4	Pu^{+4} (plutonous) PuO_2 (dioxide)	
			+5	PuO_2^+ (hypoplutonyl) Pu_2O_5 (pentoxide)	
			+6	PuO_2^{+2} (plutonyl) PuO_3 (peroxide)	
		Americium (Am)	+3	Am^{+3} (hypoamericious)	+3 Species/ +4, +5, +6 Species; +4 Species/ +5, +6 Species; +5 Species/ +6 Species
			+4	Am^{+4} (americous) AmO_2 (dioxide) $Am(OH)_4$ (hydroxide)	
			+5	AmO_2^+ (hypoamericyl) Am_2O_5 (pentoxide)	
			+6	AmO_2^{+2} (americyl) AmO_3 (peroxide)	

Table II: Elements Participating as Heteroatoms in Heteropolyanion Complex Anion Redox Couple Mediators

GROUP	SUB GROUP	ELEMENT
I	A	Lithium (Li), Sodium (Na), Potassium (K), and Cesium (Cs)
	B	Copper (Cu), Silver (Ag), and Gold (Au)
II	A	Beryllium (Be), Magnesium (Mg), Calcium (Ca), Strontium (Sr), and Barium (Ba)
	B	Zinc (Zn), Cadmium (Cd), and Mercury (Hg)
III	A	Boron (B), and Aluminum (Al)
	B	Scandium (Sc), and Yttrium (Y) – (See Rare Earths)
IV	A	Carbon (C), Silicon (Si), Germanium (Ge), Tin (Sn) and Lead (Pb)
	B	Titanium (Ti), Zirconium (Zr), and Hafnium (Hf)
V	A	Nitrogen (N), Phosphorous (P), Arsenic (As), Antimony (Sb), and Bismuth (Bi)
	B	Vanadium (V), Niobium (Nb), and Tantalum (Ta)
VI	A	Sulfur (S), Selenium (Se), and Tellurium (Te)
	B	Chromium (Cr), Molybdenum (Mo), and Tungsten (W)
VII	A	Fluorine (F), Chlorine (Cl), Bromine (Br), and Iodine (I)
	B	Manganese (Mn), Technetium (Tc), and Rhenium (Re)
VIII	Period 4	Iron (Fe), Cobalt (Co), and Nickel (Ni)
	Period 5	Ruthenium (Ru), Rhodium (Rh), and Palladium (Pd)
	Period 6	Osmium (Os), Iridium (Ir), and Platinum (Pt)
IIIB	Rare Earths	All

2 – 7 (Canceled) Without prejudice.

8. (Original) The process of claim 1, further comprising adding stabilizing compounds to the electrolyte for overcoming and stabilizing the short lifetime of oxidized forms of higher oxidation state species of the mediator oxidizing species.

9. (Canceled) Without prejudice.

10. (Currently Amended) The process of claim 1, wherein the mediator oxidizing species are super oxidizers which exhibit oxidation potentials of at least 1.7 volts at 1 molar, 25°C and pH 1 and which are redox couple species that have the capability of producing free radicals of hydroxyl or perhydroxyl, and further comprising creating free radical secondary oxidizers by reacting the super oxidizers with water<u>, adding energy from an energy source, ultra sonic and/or ultraviolet, to the anolyte portion and augmenting the secondary oxidation processes, breaking down hydrogen peroxide in the anolyte portion into hydroxyl free radicals, and increasing an oxidizing effect of the secondary oxidation processes , and further comprising generating inorganic free radicals in aqueous solutions from carbonate, azide, nitrite, nitrate, phosphite, phosphate, sulfite, sulfate, selenite, thiocyanate, chloride, bromide, iodide, and formate oxidizing species</u>.

11. (Original) The process of claim 1, further comprising using an alkaline solution, aiding decomposing of the biological materials in mixed waste derived from base promoted ester hydrolysis, saponification, of fatty acids, and forming water soluble alkali metal salts of the fatty acids and glycerin in a process similar to the production of soap from animal fat by introducing it into a hot aqueous lye solution.

12. (Original) The process of claim 1, further comprising using an alkaline anolyte solution for absorbing CO_2 from the oxidizing of mixed waste materials and forming bicarbonate/carbonate solutions, which subsequently circulate through the electrochemical cell, producing percarbonate oxidizers.

13 – 14 (Canceled) Without prejudice.

15. (Original) The process of claim 1, further comprising impressing an AC voltage upon the direct current voltage for retarding formation of cell performance limiting surface films on the electrodes or the membrane.

16 – 19 (Canceled) Without prejudice.

20. (Currently Amended) The process of claim 1, further comprising introducing an ultrasonic energy into the anolyte portion, rupturing cell membranes in the biological materials in mixed waste by momentarily raising local temperature and pressure within the cell membranes with the ultrasonic energy to above several thousand degrees and thousand atmospheres, and causing cell membrane failure, and wherein the added energy comprises using ultrasonic energy and inducing microscopic bubble expansion and implosion for reducing in size individual second phase mixed waste volumes dispersed in the anolyte.

21. (Currently Amended) The process of claim 1, further comprising introducing ultraviolet energy into the anolyte portion and decomposing hydrogen peroxide into hydroxyl free radicals therein, thereby increasing efficiency of the process by converting product ~~products~~ of electron consuming parasitic reactions, ~~ozone and~~ hydrogen peroxide, into viable free radical secondary oxidizers without consumption of additional electrons.

22. (Original) The process of claim 1, further comprising adding a surfactant to the anolyte portion for promoting dispersion of the mixed waste or intermediate stage reaction

products within the aqueous solution when the mixed waste or reaction products are not water-soluble and tend to form immiscible layers.

23. (Original) The process of claim 1, further comprising attacking specific organic molecules in the mixed waste with the mediator oxidizing species while operating at a sufficiently low temperatures and preventing formation of dioxins and furans.

24. (Original) The process of claim 1, further comprising breaking down the mixed waste materials into biological and organic compounds and attacking these compounds using as the mediator simple and/or complex anion redox couple mediators or inorganic free radicals and generating organic free radicals.

25. (Original) The process of claim 1, further comprising raising normal valence state mediator anions to a higher valence state by stripping the mediator anions of electrons in the electrochemical cell, wherein oxidized forms of weaker redox couples present in the mediator oxidizing species are produced by similar anodic oxidation or reaction with oxidized forms of stronger redox couples present and the oxidized species of the redox couples oxidize molecules of the mixed waste and are themselves converted to their reduced form, whereupon they are oxidized by the aforementioned mechanisms and the redox cycle continues.

26 – 30 (Canceled) Without prejudice.

31. (Currently Amended) The process of claim 1 ~~claim 26~~, further comprising using the mediator oxidizing species that are found in situ in the mixed waste to be decomposed, by circulating the mixed waste-anolyte mixture through the electrochemical cell wherein an oxidized form of an in situ reversible redox couple is formed by anodic oxidizing or reacting with an oxidized form of a more powerful redox couple added to or already present in the

anolyte portion and anodically oxidized in the electrochemical cell, thereby destroying biological and organic materials in the mixed waste.

32. (Currently Amended) The process of claim 1 ~~claim 26~~, further comprising using an alkaline electrolyte selected from a group consisting of NaOH or KOH and combinations thereof, with the mediator oxidizing species, wherein a reduced form of a mediator redox couple has sufficient solubility in said electrolyte for allowing desired oxidation of biological and organic materials in the mixed waste.

33. (Currently Amended) The process of claim 1 ~~claim 26~~, wherein the oxidation potential of redox reactions of the mediator oxidizing species and the biological and organic molecules in the mixed waste producing hydrogen ions are inversely proportional to electrolyte pH, and thus with a selection of a mediator redox couple increasing the electrolyte pH reduces the electric potential required, thereby reducing electric power consumed per unit mass of the mixed waste destroyed.

34. (Currently Amended) The process of claim 1 ~~claim 26~~, wherein the electrolyte is an aqueous solution chosen from acids, alkalines and salt ~~neutral~~ electrolytes ~~and mixtures thereof~~.

35. (Canceled) Without prejudice.

36. (Currently Amended) The process of claim 1 ~~claim 26~~, further comprising interchanging the mediator oxidizing species without changing equipment, and wherein the anolyte and catholyte portions of electrolyte are independent of one another and comprise aqueous solutions of acids, alkali or salts ~~the electrolyte is an acid, neutral or alkaline aqueous solution~~.

37 – 43 (Canceled) Without prejudice.

44. (Currently Amended) The process of claim 1 ~~claim 26~~, wherein the oxidizing and destroying mixed waste materials comprises oxidizing and destroying a combination of liquids and solids in mixed waste.

45. (Currently Amended) The process of claim 1 ~~claim 26~~, further comprising requiring removing and treating precipitates resulting from combinations of the oxidizing species and other species released from the mixed waste during destruction and sterilization.

46. (Canceled) Without prejudice.

47. (Currently Amended) The process of claim 1 ~~claim 26~~, further comprising separating a catholyte portion of the electrolyte from the anolyte portion with a membrane, operating the electrochemical cell at a higher current density across the membrane, and near a limit over which there is the possibility that metallic anions may leak through the membrane in small quantities, and recovering the metallic anions through a resin column, thus allowing a greater rate of destruction of mixed waste materials in the anolyte portion.

48. (Currently Amended) The process of claim 1 ~~claim 47~~, wherein the catholyte portion further comprises an aqueous solution and the electrolyte in the solution is composed of acids, alkali or neutral, and further comprising adding oxygen to the solution when HNO_3 or NO_3^- can occur in the catholyte portion, controlling concentration of electrolyte in the catholyte to maintain conductivity of the catholyte portion desired in the electrochemical cell, providing mechanical mixing and/or ultrasonic energy induced microscopic bubble formation, and implosion for vigorous mixing in the catholyte solution for oxidizing the nitrous acid and small amounts of nitrogen oxides NO_x, introducing air into the catholyte portion for promoting the oxidizing of the nitrous acid and the small amounts of NO_x, and diluting any hydrogen produced in the catholyte portion before releasing the air and hydrogen.

49. (Original) Apparatus for the use of a treatment of waste process comprises oxidizing mixed waste by (a) <u>dissolution</u> of transuranic elements plutonium, neptunium, americium, curium, and californium, and/or compounds thereof in transuranic waste (TRUW), low level waste (LLW), low level mixed waste (LLMW), special case waste (SCW), and greater than class C (GTCC) LLW;. (b) <u>destruction</u> of non-fluorocarbon organic component in the waste ; or (c) <u>decontamination</u> of transuranic/actinide contaminated equipment, further comprising an electrochemical cell, an aqueous electrolyte disposed in the electrochemical cell, a hydrogen or hydronium ion-permeable or selective membrane, disposed in the electrochemical cell for separating the cell into anolyte and catholyte chambers and separating the electrolyte into aqueous anolyte and catholyte portions, electrodes further comprising an anode and a cathode disposed in the electrochemical cell respectively in the anolyte and catholyte chambers and in the anolyte and catholyte portions of the electrolyte, a power supply connected to the anode and the cathode for applying a direct current voltage between the anolyte and the catholyte portions of the electrolyte, and oxidizing of the materials in the anolyte portion with a mediated electrochemical oxidation (MEO) process wherein the anolyte portion further comprises a mediator in aqueous solution for producing reversible redox couples used as oxidizing species and the electrolyte is an acid, neutral or alkaline aqueous solution.

50. (Original) The apparatus of claim 49, further comprising an anolyte reaction chamber and buffer tank housing the bulk of the anolyte solution, an input pump to enter liquid mixed waste materials into the anolyte reaction chamber, a spray head and stream head to introduce the anolyte from the electrochemical cell into the anolyte reaction chamber in such a manner as to promote mixing of the incoming anolyte and the anolyte mixture in the anolyte reaction chamber, a hinged lid to allow insertion of mixed waste into the anolyte portion as

liquid, solid of combination of both, a locking latch to secure the lid during operation of the system, a suction pump attached to the buffer tank to pump anolyte from the buffer tank to the anolyte reaction chamber, a input pump to pump anolyte from the anolyte reaction chamber back to the buffer tank, and an air pump to pump off gases from the anolyte reaction chamber back to the buffer tank for further oxidation.

51. (Canceled) Without prejudice.

52. (Currently Amended) The process of claim 1 ~~The apparatus of claim 49~~, further comprising additives disposed in the electrolyte for contributing to kinetics of the mediated electrochemical processes while keeping it from becoming directly involved in the oxidizing of the mixed waste materials, and stabilizer compounds disposed in the electrolyte for stabilizing higher oxidation state species of oxidized forms of the reversible redox couples used as the mediator oxidizing species in the electrolyte.

53 – 63 (Canceled) Without prejudice.

64. (Original) The apparatus of claim 49, wherein the power supply energizes the electrochemical cell at a potential level sufficient to form the oxidized form of the redox couple having the highest oxidation potential in the anolyte, and further comprising a heat exchanger connected to the anolyte chamber for controlling temperature between 0°C and slightly below the boiling temperature of the anolyte with the heat exchanger before the anolyte enters the electrochemical cell enhancing the generation of oxidized forms of the anion redox couple mediator, and adjusting the temperature of the anolyte to the range between 0°C and slightly below the boiling temperature when entering the anolyte reaction chamber.

65 – 71 (Canceled) Without prejudice.

72. (Original) The apparatus of claim 49, further comprising an ultrasonic source connected to the anolyte for augmenting secondary oxidation processes by heating hydrogen peroxide containing electrolyte to 4800°C, at 1000 atmospheres for dissociating hydrogen peroxide into hydroxyl free radicals and thus increasing concentration of oxidizing species and rate of waste destruction and for irradiating cell membranes in biological materials in the mixed waste to momentarily raise the temperature within the cell membranes to above several thousand degrees, causing failure of the cell membranes, and creating greater exposure of cell contents to oxidizing species in the anolyte.

73. (Canceled) Without prejudice.

74. (Original) The apparatus of claim 49, further comprising an anolyte reaction chamber holding most of the anolyte portion and a foraminous basket, a penetrator attached to the basket to puncture solids increasing the exposed area, and further comprising an external CO_2 vent connected to the reaction chamber for releasing CO_2 into the atmosphere, a hinged lid attached to the reaction chamber allowing insertion of waste into the anolyte portion as liquid, solid, or mixtures of liquids and solids, an anolyte pump connected to the reaction chamber, an inorganic compounds removal and treatment system connected to the anolyte pump for removing chlorides, and other precipitate forming anions present in biological and organic waste being processed, thereby precluding formation of unstable oxycompounds.

75. (Currently Amended) The apparatus of claim 49 ~~claim 74~~, further comprising an off-gas cleaning system, comprising scrubber/absorption columns connected to the vent, a condenser connected to the anolyte reaction chamber, whereby non-condensable incomplete oxidation products, low molecular weight organics and carbon monoxide are reduced to acceptable levels for atmospheric release by the gas cleaning system, and wherein the anolyte

off-gas is contacted in the gas cleaning system wherein the noncondensibles from the condenser are introduced into the lower portion of the gas cleaning system through a flow distribution system and a small side stream of freshly oxidized anolyte direct from the electrochemical cell is introduced into the upper portion of the column, resulting in a gas phase continuously reacting with the oxidizing mediator species as it rises up the column past the down flowing anolyte, and external drain, for draining to an organic compound removal system and the inorganic compounds removal and treatment system, and for draining the anolyte system, wherein the organic compounds recovery system is used to recover mixed waste materials that are benign and do not need further treatment, and mixed waste materials that will be used in the form they have been reduced.

76. (Currently Amended) The apparatus of claim 49 ~~claim 74~~, further comprising thermal control units connected to heat or cool the anolyte to a selected temperature range when anolyte is circulated into the reaction chamber through the electrochemical cell by pump on the anode chamber side of the membrane, a flush for flushing the anolyte, an in-line filter preventing solid particles large enough to clog electrochemical cell flow paths from exiting the reaction chamber, an inorganic compound removal and treatment system and drain outlets connected to the anolyte reaction chamber, whereby residue is pacified in the form of a salt and periodically removed, and a filter is located at the base of the reaction chamber to limit the size of exiting solid particles to approximately 1mm in diameter.

77. (Canceled) Without prejudice.

78. (Original) The apparatus of claim 49, further comprising an electrolyte containment boundary composed of materials resistant to the oxidizing electrolyte selected from

a group consisting of stainless steel, PTFE, PTFE lined tubing, glass and ceramics, and combinations thereof.

79. (Original) The apparatus of claim 49, further comprising an anolyte recovery system connected to a catholyte pump, a catholyte reservoir connected to the cathode portion of the electrochemical cell, a thermal control unit connected to the catholyte reservoir for varying the temperature of the catholyte portion, a bulk of the catholyte portion being resident in a catholyte reservoir, wherein the catholyte portion of the electrolyte flows into a catholyte reservoir, and further comprising an air sparge connected to the catholyte reservoir for introducing air into the catholyte reservoir.

80. (Currently Amended) The apparatus of claim 49 ~~claim 74~~, further comprising an anolyte recovery system wherein some anions in the anolyte cross the membrane and are removed through the anolyte recovery system to maintain process efficiency or cell operability ~~for capturing the anions~~ and for reintroducing the recovered mediator anions into the anolyte chamber upon collection from the catholyte electrolyte, an off-gas cleaning system connected to the catholyte reservoir for cleaning gases before release into the atmosphere, and an atmospheric vent connected to the off-gas cleaning system for releasing gases into the atmosphere, wherein cleaned gas from the off-gas cleaning system is combined with unreacted components of the air introduced into the system and discharged through the atmospheric vent 47.

81. (Currently Amended) The apparatus of claim 49 ~~claim 74~~, further comprising a screwed top on the catholyte reservoir to facilitate flushing out the catholyte reservoir, a mixer connected to the catholyte reservoir for stirring the catholyte, a catholyte pump connected to the catholyte reservoir for circulating catholyte back to the electrochemical cell, a drain for draining catholyte, a flush for flushing the catholyte system, and an air sparge connected to the housing

for introducing air into the catholyte reservoir, wherein the catholyte portion of the electrolyte is circulated by pump through the electrochemical cell on the cathode side of the membrane, and wherein contact of oxidizing gas with the catholyte portion of the electrolyte is enhanced by promoting gas/liquid contact by mechanical and/or ultrasonic mixing.

82. (Canceled) Without prejudice.

83. (Currently Amended) The apparatus of claim 49, further comprising a controller, a microprocessor, a monitor and a keyboard connected to the cell for inputting commands to the controller through the keyboard responding to the information displayed on the monitor, <u>a controller with a control keyboard for input of commands and data, a monitor screen to display operations and functions of the systems, status lights for displaying information about status of the treatment of the mixed waste material,</u> a program in the controller sequencing the steps for operation of the apparatus, program having pre-programmed sequences of operations the operator follows or chooses other sequences of operations, the controller allows the operator to select sequences within limits that assure a safe and reliable operation, the controller sends digital commands that regulate electrical power to pumps, mixers, thermal controls, ultraviolet sources, ultrasonic sources, CO_2 vents, air sparge, and the electrochemical cell, the controller receives component response and status from the components, the controller sends digital commands to the sensors to access sensor information through sensor responses, sensors in the apparatus provide digital information on the state of components, sensors measure flow rate, temperature, pH, CO_2 venting, degree of oxidation, and air sparging, the controller receives status information on electrical potential across the electrochemical cell or individual cells in a multi-cell configuration and between reference electrodes internal to the anolyte and catholyte

chambers of the electrochemical cells and the current flowing between the electrodes within each cell.

84 – 85 (Canceled) Without prejudice.

86. (Currently Amended) The apparatus of claim 49, further ~~A mixed waste oxidizing process,~~ comprising a mixed waste oxidizing process with an operator engaging an 'ON' button on a control keyboard, a system controller which further comprises a microprocessor, running a program and controlling a sequence of operations, a monitor screen displaying process steps in proper sequence, status lights on a panel providing status of the process, opening a lid and placing the mixed waste in a basket as a liquid, solid, or a mixture of liquids and solids, retaining a solid portion of the mixed waste and flowing a liquid portion through the basket and into an anolyte reaction chamber, activating a locking latch after the mixed waste is placed in the basket, activating pumps and circulating anolyte and catholyte, once the circulating is established throughout the system, operating mixers, once flow is established, turning on thermal control units, and initiating anodic oxidizing and electrolyte heating programs, energizing an electrochemical cell to electric potential and current density determined by the program of the controller, using programmed electrical power and electrolyte temperature ramps for maintaining a predetermined mixed waste destruction rate profile as a relatively constant reaction rate as more reactive waste components are oxidized, thus resulting in the remaining waste becoming less and less reactive, providing more vigorous oxidizing conditions by activating ultrasonic and ultraviolet systems in the anolyte reaction chamber and catholyte reservoir, releasing CO_2 from the biological and organic materials in the mixed waste oxidizing process in the anolyte reaction chamber, activating air sparge and atmospheric vent in a catholyte system, monitoring progress of the process in the controller by cell voltages and currents, monitoring CO_2, CO, and O_2 gas

composition for CO_2, CO and oxygen content, decomposing the mixed waste into water and CO_2, the latter being discharged out of the CO_2 vent, air sparging drawing air into a catholyte reservoir, and discharging excess air out of an atmospheric vent, determining with an oxidation sensor that desired degree of mixed waste destruction has been obtained, setting the system to standby, and executing system shutdown using the controller keyboard system operator.

87. (Currently Amended) The process of claim 49 ~~claim 86~~, further comprising placing the system in a standby mode during the day and adding mixed waste as it is generated throughout the day, placing the system in full activation during non-business hours, operating the system at low temperature and ambient atmospheric pressure and not generating toxic compounds during the oxidation of the mixed waste, making the process indoors compatible, scaling the system between units small enough for use by a single practitioner and units large enough for replacing hospital incinerators, releasing CO_2 oxidation product from the anolyte system out through the CO_2 vent, and venting off-gas products from the catholyte reservoir through the atmospheric vent.

88. (Canceled) Without prejudice.